3.2 GEOLOGY AND SOILS

3.2.1 Applicable Sections in FERC Documents

Please refer to Section 3.1 in the FERC Final EIS and Resource Report 6, Geological Resources, in Exhibit F-1 of GSX-US's original application to FERC.

3.2.2 Issue 4: Active Earthquake Faults~~1~~

Issue Summary

Description of Problem

The Final EIS states that the U.S. onshore pipeline route does not cross any potentially active faults. Easterbrook et al. (2000), which is cited in the EIS, documents activity along both the Sumas and Vedder Mountain faults since 1964, which indicates these faults are currently active. The cited reference also delineates the location of these faults more clearly than in Figure 3.1.2-1 of the Final EIS.

Further, the Final EIS states that earthquakes could result in soil liquefaction along certain segments of the route. No mention is made of potential displacements from potentially active faults such as the Sumas and Vedder Mountain faults.

Ecology Requirement

Include an additional figure identifying these potentially active faults in relation to the proposed pipeline route in the environmental review. In pipeline engineering and construction, accommodate the increased potential for fault movements in these areas. Include a discussion of environmental impacts resulting from potential pipeline rupture and mitigation measures.

Affected Environment

Figure 3-1 shows the projected locations of the Vedder and Sumas Mountain faults in relation to the pipeline alignment. The projected Vedder Mountain Fault is approximately 1 mile east of, and parallel to, the proposed pipeline alignment. The projected Sumas Fault crosses the proposed pipeline route somewhere between Milepost 5 and Milepost 8.

Relative to the pipeline route, both seismic acceleration and seismic velocity predictions reach peak values in the eastern reaches of the Gulf Islands. Most of the identified potentially active faults also lie within the Gulf Islands, south of Pender and Saturna islands, between MP 10.4 and MP 27.3. One of the most prominent fault zones in the area occurs within U.S. waters between MP 10.4 and 11.0, and one other possible feature was identified in the southern Strait of Georgia at MP 5.7 (GSX-Canada 2001).

Figure 3-1 Project Area Faults

Impacts

GSX-US

Potential impacts associated with liquefaction would be the same as the GSX-Canada project, described below.

GSX-Canada

The Pacific Northwest, which includes the pipeline route, is an area of high seismic activity. This activity, as manifest by earthquakes, can result in ground vibration, tsunamis, ground upheaval, marine and terrestrial landslides, and soil liquefaction. Liquefaction potential is low to moderate for the terrestrial segment of the proposed route. The areas along the pipeline route that are susceptible to seismic liquefaction coincide with those areas where a high groundwater level will cause buoyant uplift.

Moderate to large earthquakes are known to have resulted in a variety of underwater landslides and coastal liquefaction phenomena. All of these events have potential to increase risk of pipeline rupture, the degree of risk being dependent on the magnitude of the event, the characteristics of the pipeline route, and the pipeline design specifications. In the event of a line break, most gas would bubble to the surface and escape to the atmosphere. Pressure-sensitive shut-off valves on both shores could be remotely or locally operated to isolate the ruptured marine segment. The volume of confined gas would escape to a point where it equalized with external pressure. Some bottom scour could occur near the leak or line break depending on the direction it faced. Temporary, localized disturbance of benthic flora and fauna would occur (GSX-Canada 2001).

Terasen Gas Alternative

No seismic analysis is available for the Terasen Gas Alternative.

No Action Alternative

Impacts of the proposed project would not occur.

Mitigation Measures

Proposed Action

No additional analysis required.

Terasen Gas Alternative

No additional analysis required.

No Action Alternative

Impacts of the proposed project would not occur.

Significant Unavoidable Adverse Impacts

No additional analysis required.

3.2.3 Issue 5: Potential Scour Impacts~~2~~

Issue Summary

Description of Problem

Final EIS Section 3.2 does not adequately respond to Ecology's Draft EIS comment requesting the name and location of waterbodies with potential scour impacts.

Ecology Requirement

Discuss locations of waterbodies with potential scour impacts in the environmental review.

Affected Environment

No additional analysis required.

Impacts

GSX-US

Sediments composing the substrate below active stream channels are susceptible to scour during flood conditions. The potential for stream scour depends largely on flood flow characteristics and the grain size of bottom sediments. Stream scour could expose a pipeline that is underneath a stream if scour depths exceed pipe burial depths.

GSX-US used a 100-year flood as the basis for estimating the depth of bottom scour for the streams crossed by the pipeline. Depending on depth of channel and the size of the waterbody, GSX-US placed all of the waterbodies into one of two categories. The first category includes waterbodies where most of the water during a 100-year flood would not be contained within the confines of the immediate channel. The second category includes larger and deeper waterbodies where the water during a 100-year flood would be contained within the confines of the immediate channel with only limited overbank flooding.

For the smaller waterbodies in the first category, the surface area of flooding during a 100-year return flood would generally be over the bank and widespread. In these cases, the velocity of flow would be below the threshold to produce significant bottom scour except for those waterbodies with loose sand and silt channel substrate. For the waterbodies in the first category,

GSX-US conservatively estimates that the depth of scour would be equal to or less than the height of the channel. Estimated scour depths during a 100-year return flood for the waterbodies in the first category generally range from 3 to 5 feet.

A 100-year flood in waterbodies in the second category would generally result in higher water velocities and potentially greater levels of scour. To estimate scour depths for these waterbodies, GSX-US used accepted stream hydrology analytical techniques and an empirical rule relating to scour depth suggested by Terzaghi (1936). This assessment required various drainage basin parameters and stream flow discharge information. The drainage basin parameters, including stream channel gradients, widths, normal depths of flow, and bank heights for streams crossed by the project, were obtained from topographic maps, field observations, and Ecology's Web site (Williams Pipeline Company 2003).

GSX-Canada

The potential impacts associated with stream scour and the methods for assessment would be the same as the GSX-US project.

Terasen Gas Alternative

No analyses of stream scour are available for the Terasen Gas Alternative.

No Action Alternative

Impacts of the proposed project would not occur.

Mitigation Measures

Proposed Action

No additional analysis required.

Terasen Gas Alternative

No additional analysis required.

No Action Alternative

Impacts of the proposed project would not occur.

Significant Unavoidable Adverse Impacts

No additional analysis required.